Summary

The Anisa theory of development provides a framework from which a diagnostic and prescriptive program of reading instruction may be conceived. Objectives based on processes that underlie the development of psychological potentialities and those based on the content aspects of reading have been derived, classified, and developmentally ordered according to the basic skills of learning to read. As the program is implemented and as research designed to test hypotheses of the theory is carried out, the objectives, diagnostic instruments, and teaching strategies of the program will be modified and refined. Because the Anisa approach to reading instruction accounts for both the process and content aspects of the curriculum, a significant breakthrough in giving all children an equal opportunity to read is anticipated.

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NUTRITION AND DEVELOPMENT

By DR. S. P. RAMAN and ELIZABETH L. BOWEN

The coherence and efficacy of any educational system to a large extent lies in the comprehensiveness of its theory of development—our understanding of the process of man's becoming. As Jerome Bruner points out, "theories of development are guides for understanding the perfectability of man as well as his vulnerability." The organismic view of man provides the Anisa educational system with the broadest and most comprehensive framework for purposefully integrating all that is known to date about human growth and development.

The Anisa theory of development defines development as the process of translating man's potentialities into actuality—an epigenetic process initiated and sustained by the organism's interaction with the environment. Development is therefore not just an increase in size, but is a process of change involving an increase in complexity of organization and functioning both physiologically and psychologically.

The theory of development recognizes two broad and interdependent categories of potentialities—biological and psychological. It identifies nutrition as the key factor in the actualization of the biological potentialities and fixes learning as the fundamental factor in the development of the psychological potentialities.

While the role of nutrition in growth and maturation may be self-evident to researchers in the biomedical disciplines, its role in education as traditionally conceived is not so evident; hence the need for a theory of development that explains the relationship between biological and psychological development.

The Anisa theory not only shows how proper nutrition is essential for the maintenance of the biological integrity of the organism but why it is a prerequisite for the actualization of psychological potentialities. In other words, learning depends in the first place on the existence of a sound physical and neurological base. The integrity of the child as a biological organism on the one hand, the characteristics of his environment on the other, and the interaction between them—these factors define and determine his functional capacities. No educational program can therefore be considered comprehensive if it merely concentrates on enriching the intellectual, social and

cultural environment without providing the optimum conditions in the micro-environment of the child for maintaining his own biological integrity.

Progress in our understanding of the biological correlates of learning—genetic, neural, glandular, metabolic (all of which have particular nutritional requirements) brings to a sharp focus the diverse etiologies of disorders that are capable of interrupting the normal sequential development of the organism. This area is of tremendous interest to educators and clinical investigators in developing the ability to recognize problems early and identify the child who is potentially vulnerable to developmental (learning) deficiencies. Given the genetic endowment of a child, of all the factors that suppress his potential, malnutrition is among the most detrimental.

Integrity of the Central Nervous System

While a comprehensive review of the research on the deleterious effect of malnutrition on the growth, development and learning potential of the human organism cannot be undertaken here, enumerating briefly the most important findings that are relevant to education will be useful. It has been established that there are certain periods of vulnerability in the early growth of the human organism, called sensitive or critical periods, during which the presence or absence of a developmental modifier causes a significant alteration in the course of normal development. Periods of rapid growth are critical in that the organism is particularly vulnerable to nutritional injury at these times.

There is strong evidence that critical periods extend over a time continuum starting at conception and going well beyond the preschool years. The effects of inadequate nutrition on growth and mental development depend to a large extent on the point in the continuum at which the deprivation occurs, the severity and duration of the deprivation, and the nutrients of which the organism is deprived. Considering all the developmental influences that man is subject to, those that occur during the very early years of life have the most profound effect.

This early period of susceptibility includes pre- and post-natal life because the human body and the brain are incompletely differentiated at the time of birth, and they develop as the infant responds to environmental stimulii. During this period, the central nervous system is on a time scale of growth different from that of the rest of the body. The human brain grows most rapidly during the last trimester of the intrauterine life and the post-natal period.

All studies in this support the view that the earliest period of infancy is one of the most critical for the developing brain and central nervous system. Learning competence is defined in the Model as the ability to differentiate, integrate and generalize experience. Since experience is necessarily mediated through the receptor organs of the central nervous system, defective formation of the system because of malnutrition will assuredly impair its functioning and hence learning ability.

No educator would deny the critical role of the central nervous system and of the intersensory integration in the acquisition of early sensory-motor and manipulative skills which are prerequisites for cognitive, language, and socio-emotional development. One of the most valuable contributions of the Montessori method is "sensory education," i.e., learning to process information from sense receptors through the central nervous system. Intersensory integration is vital to such processing. Information from the environment is mediated by the receptor organs located in the eyes, ears, nose and skin. The rods and cones of the eye, the cochlea of the ear, the olfactory receptors of the nose, the taste buds of the tongue and the touch corpuscles of the skin are all connected to the brain by pathways in the central nervous system composed of neurons, glial cells, and connecting sites among them called synapses. Poor intersensory integration was one of the most common symptoms found in children suffering from early nutritional deficiency. Lack of intersensory integration also affects the maturation of the organs of perception and the abilities on which they depend—visual, auditory and kinesthetic —all of which are heavily implicated in achieving reading and writing skills. If the development of these abilities is uneven due to early malnutrition, children will come to school with a significant handicap when it comes to learning how to read and write. To this extent, poor intersensory integration is a suppressor of psychological potentialities because it impairs the child's ability to learn.

Biological Correlates of Learning and Behavior

Even after an adequate structuring of the central nervous system has been established, poor nutrition during the following years can severely impair the neuro-physiological bases of learning and behavior. Advances in biochemical psychiatry, neurology and physiological psychology have increased our appreciation of the critical role of nutrition in the functioning of the central nervous system. Current or antecedent nutritional injury can cause many behavioral aberrations. Pyridoxine deficiency (vitamin B_6), for example, causes severe irritability and uncontrolled convulsive seizures. Moreover, an ade-

quate state of nutrition is an essential prerequisite for good attention and for sensitive responses to the environment.

One of the most palpable clinical manifestations of malnutrition in children is a striking combination of apathy, irritability, extreme nervous tension, listlessness and hyperactive behavior. This apathy inhibits volitional competence as the child does very little as a result of his own will or intention. Apathy itself is a sign of lack of motivation. Unresponsiveness on the part of the child characterizes his relation to people as well as objects. When his relationship with other people is affected, his development of moral competence may also be inhibited. This ultimately leads to impairment of all other competencies which are then reflected in the child's attitudes and value systems at a later age. If the child is unresponsive to the surroundings, little or no learning takes place. Obesity is a metabolic dysfunction which ushers in a myriad of impairments, both biological and psychological. Current research efforts in this area point to the possibility of alleviating this syndrome by correcting nutritional imbalances.

There is a synergetic relation between malnutrition, allergy and infection in humans. Malnutrition has deleterious effects on the body's nitrogen balance, thus lowering significantly the levels of certain essential serum proteins (complement and circulating gamma globulins), levels which are critical to the organism's defense mechanisms or immunological response to infection. Malnutrition, metabolic disorders due to introduction of toxicants into the system, allergy and infection act either alone or synergistically to produce either chronically or recurrently sick children or cerebral dysfunction in children who are unresponsive to sensory stimuli and have behavioral problems. A significant number of cases of severe learning impairment associated with the hyperkinetic syndrome, also termed Minimal Brain Dysfunction (MBD), have been traced to nutritional imbalances and metabolic dysfunction amenable to diet therapy. Prescription of megavitamins and complete elimination of foods containing additives (artificial colors and flavors) and foods rich in compounds containing salicylates have produced significant results in correcting the MBD syndrome and improving academic achievement. In cases where the hyperactive child was also found to be hypoglycemic, placing him on a high protein, low starch hypoglycemic diet eliminated the behavior problem.

Thus evidence is fast accumulating in support of the view that undernutrition interferes with the development of the central nervous system and has effects on performance which include (a) a loss of

learning time, (b) an impairment of learning during critical periods of development, and (c) the changes in the individual's motivation and personality. These findings represent a major-contribution to the knowledge required by the planners of educational programs. The implications of these findings for the total educational program are too evident to be ignored. Trying to understand more fully the performance of the central nervous system as it relates to intelligence, memory, learning and behavior ranks among the major challenges faced by psychologists and educators of today.

Based upon experiences working with disadvantaged children and their families, many educators have taken the stand that the environmental inadequacy is the primary factor contributing to intellectual deficiency, behavioral abnormalities and the resultant inability of the child to cope with the increasing complexities of the society. Such a stand is stark evidence of the growing gulf in the interdisciplinary understanding between biomedical and the behavioral sciences. Biochemistry and molecules do not dictate all behavior and we need to realize that biochemical changes may be a result of behavior as well as the cause of behavior.

Role of Parents and Home Environment

I. J. Gordon, D. P. Weikart and G. Nimnicht are among those who have advocated and implemented parent education and home visits as a part of early intervention programs at different preschool ages. In the Anisa framework, the parents (particularly the mother-to-be), the fetus, the infant, and the preschool child assume central positions in the overall scheme of educational planning. The child is viewed as a part of an ecological system in which he is always experiencing some form of interaction with the environment. Some interactions can be stimulating and supporting and thus provide the requisite conditions for optimal growth and development while others can be suppressive of potential. During the child's formative years the most significant and immediate influence is the mother—a key element in the basic ecological system. Hence, intervention is planned to include the father and the mother, as well as the unborn child.

Even though we have no true ante-natal or post-natal norms, this should not be used as an excuse for indifference in providing adequate environmental conditions for the developing fetus and the infant. Environmental adequacy is largely determined by the mother's physical, psychological and emotional status during the successive phases of motherhood. From our knowledge of intrauterine develop-

ment and pre-natal studies we can safely conclude that the environmental influences—biological, psychological and cultural—begin to operate from the moment of conception. Of these influences, malnutrition is the most detrimental. The human environment of the newborn child is restricted practically to a single person—the infant's mother or her substitute. This limitation in the infant's habitat is fortunate insofar as it permits one to have close control over the biological and psychological factors that are operative during the early part of the child's life. The pivot of all development in this circumscribed environment is the quality of the mother-child relation during the early stages of the growth. Therefore, this relationship is seen by Anisa as a central ecological factor in the growth and development of the child.

The ultimate objective of any intervention program should be prevention. The Anisa Model makes provision for intervening in the anticipated life of a child a year or so before his conception by insuring that the nutritional status of the parents-to-be will maximize the likelihood of conceiving a fully-functioning, healthy child. Since the provision of adequate nutrition remains important throughout life, the Model provides for collaborative efforts of community, school and home to maintain an optimum nutritional status in all students and staff.

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MATHEMATICS INSTRUCTION: AN ANISA APPROACH

By DR. DONALD T. STREETS

A first grade youngster came home from school one day with a perplexed look on his face. Before either of his parents could respond to his expression, he volunteered an explanation. "Well, we have to do times problems (meaning multiplication exercises). But if I have to do times problems, then I have to know what 'times' means. If I know what 'times' means, then I can work all of the problems. But if I don't know what 'times' means, then I can't work any of them," he concluded.

This simple observation made by a first-grader highlights the fundamental issue that all children confront in attempting to understand number relations. And yet, while acknowledging the legitimacy of addressing the issue of meaning in number relations, most teachers would be sorely pressed to describe what constitutes the underlying "meaning", let alone how to go about assisting children to comprehend it.

Most of the better attempts, to date, center on the identification and organization of examples of the basic operations of mathematics (addition, subtraction, multiplication and division) in terms of their progressive complexity and the algorithms pertinent to finding the solution to each example. More traditional approaches continue to center on the mere manipulation of symbols—exercises in the use of abstractions in the absence of comprehending the underlying meaning on the part of the student.

Modern Math: Its Success and Failure

Math educators hoped that the "new math" would usher in the kind of reform that would address this fundamental need for the establishment of meaning prior to the handling of symbolic abstractions in the form of numbers. While significant progress was made in (1) identifying the levels of complexity characteristic of the four basic mathematical operations, and (2) deriving a standardized language for describing those operations consistent with the logical propositions upon which they are based—a fundamental mistake was committed. It was a mistake of omission, namely, the disregard for the developmental stages, particluarly in the area of cognition, that the child goes through as he thinks about the world in general and as he contemplates quantitative relationships in particular.